

TECHNICAL MEMORANDUM 06-05

January 19, 2007

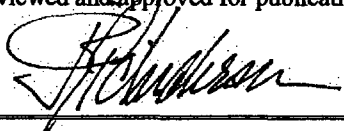
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Subject: *Kodak CFX Decommissioning Environmental Report*

PUBLIC VERSION

Revision: 1

ENDORSEMENT: This document contains the results of research and technical analysis which have been reviewed and approved for publication by:



January 19, 2007

Barton P. Anderson, Principal

Date

1 INTRODUCTION

- 1.1 Eastman Kodak Company Research Laboratories (EKC) intends to decommission portions of Building 82 of the Activation Analysis Facility, located in Rochester, New York, and terminate U.S. Nuclear Regulatory Commission (NRC) Special Nuclear Material License SNM-1513. Upon license termination, portions of Building 82 will be released by EKC for unrestricted use.

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eastern boundary of KPE (excluding the Genesee Gorge) to 340 feet in Kodak Park Section S (KPS). The most prominent topographic feature within Kodak Park is the Genesee River Gorge, located along the eastern boundary of Kodak Park. The gorge is approximately 150 feet deep with an average wall slope of approximately 87 percent. The elevation of the base of the gorge at river level is approximately 40 feet.

- 3.3.2 The site geologic setting includes overburden soils consisting of fill materials, lacustrine silts and sands, and glacial till. These overburden deposits overlie southward dipping bedrock strata consisting of the Grimsby and Queenston Formations. Structural features within the bedrock including fractures and faults were identified during the RCRA³ Facility Investigation (RFI) in 1997 and also in previous investigations. These structural features appear to be related to a major fracture system which traverses northeast KPE from northwest to southeast. Groundwater flow within the overburden is influenced by subsurface utilities, with regional flow being downward and to the east.⁴
- 3.3.3 A geological map of Rochester region of New York State is presented in Appendix B along with a legend for its interpretation. More complete information may be found at the NY Geological website at the following URL:

<http://geology.about.com/library/bl/maps/blnewyorkmap.htm>

3.4 WATER RESOURCES

3.4.1 Surface Water

- 3.4.1.1 The Rochester region has a combination of 24 parallel north-south river valleys and the effects of a massive continental glacier have given Western New York a series of lakes, river cataracts, and steep-walled canyons. The Genesee River is the dominant river in this system and is located immediately to the east of the EKC site. It is the only stream to completely cross the State of New York.
- 3.4.1.2 The Genesee meanders down from an elevation of 1,610 feet at the Pennsylvania border with a grade of about 10 feet per mile. It crosses over six cataracts, three in Letchworth State Park, and three in the City of Rochester. The Genesee with its falls is an important source of water power. It ends by joining Lake Ontario at an elevation of 246 feet above sea level. The Genesee's main tributaries are Black Creek, Honeoye Creek, Canaseraga Creek, and Wiscoy Creek.
- 3.4.1.3 Lake Ontario is located approximately 4 miles to the north of the EKC site and is the eastern-most of the 5 Great Lake system. Although it has the smallest surface area (7,540 square miles) of all the Great Lakes, it has a volume greater than that of Lake Erie. It is the 14th largest lake in world and has a shoreline 712 miles long.

³ Resource Conservation and Recovery Act (RCRA)

⁴ Northeast KPE Facility Investigation Report, Kodak park Corrective Action Program, July 1997, Blasland, Bouch & Lee, Inc.

3.4.2 Groundwater

- 3.4.2.1 The EKC site is located within the Irondequoit Creek basin which contains the Irondequoit Aquifer. Alluvial silt, sand and gravel left behind from retreating glaciers provided the porous conditions required for aquifer genesis. The portion of the aquifer under the EKC site flows in an easterly direction toward Irondequoit Bay and is primarily recharged from precipitation. Historically, the aquifer was once the primary source of freshwater for the rural residents. As population increased and the area developed from a rural to urban setting, fewer people became dependant on this aquifer as public water systems became available. Today, few residents still draw from the aquifer as the aquifer has become marginalized by chemical contaminants due to industrial use of the land and storm-water run-off.
- 3.4.2.2 Groundwater is present in unconsolidated deposits (overburden) and all bedrock formations beneath Kodak Park. Groundwater in the overburden flows through primary pore spaces. The type of overburden deposit (e.g. grain size, sorting, and deposit geometry) affects the direction and rate of groundwater movement.
- 3.4.2.3 Groundwater flow in bedrock under Kodak Park occurs principally through joints and fractures in the bedrock, and through porous layers in the upper portion of the bedrock formations beneath KPE caused by weathering and chemical processes. Five principal hydrostratigraphic units have been identified beneath most of Kodak Park area. These are discussed in detail in the RFI investigation report⁵.

3.5 ECOLOGICAL RESOURCES

- 3.5.1 The regional ecology immediately surrounding the EKC site is urban with a large freshwater aquatic environment (Lake Ontario) located 4 miles to the north. Numerous public parks have been created within the Rochester City limits and provide the only available open-space wildlife habitat.
- 3.5.2 Appendix C lists all species declared by the New York Department of Environmental Conservation to be of importance whether they are endangered, threatened, or of special concern. From this list the Bog Turtle (*Clemmys muhlenbergii*), Short-eared Owl (*Asio Flammeus*), Loggerhead Shrike (*Lanius ludoncianus*), Golden Eagle (*Aquila chrysaetos*), and Peregrine Falcon (*Falco peregrinus*) are the only threatened species to have a slight potential to be present near the site.
- 3.5.3 The Short-eared Owl has only been sporadically sighted along the eastern shore of Lake Ontario in recent years and lives primarily in open habitat that can support a large supply of rodents, especially the Meadow Vole (*Microtus pennsylvanicus*). The Short-eared Owl is thought to be highly migratory in its northern range (including New York) and is usually only encountered during spring and fall. As of this report, no data has been found to determine whether a sighting has been recorded in the vicinity of the EKC site, but the general nature of the species makes it unlikely.

⁵ ibid. Section 4.

- 3.5.4 The Bog Turtle and the Loggerhead Shrike have not been collected or sighted in the vicinity to the EKC site in recent years.
- 3.5.5 The Golden Eagle and the Peregrine Falcon are known to have been sighted within vicinity of the EKC in the recent past. Both raptors are rebounding from their decline in the mid- and late-1900's. The Golden Eagle has a more widely spread distribution than the Peregrine Falcon with a healthier population although not urbanized. The Peregrine Falcon is known to inhabit urban areas, preying on gregarious urban species such as the Rock Dove (*Columba livia*). EKC is an active participant in the Rochester Peregrine Falcon Project and has erected a successful nesting-box atop one its office towers in downtown Rochester, NY, about 3.5 miles from the EKC Research Facility.
- 3.5.6 Lake Ontario is host to a number of species considered to be of importance from a conservation standpoint but the proposed action would not be a threat to disrupt the ecological balance of this aquatic environment.

3.6 METEOROLOGY, CLIMATOLOGY, AND AIR QUALITY

3.6.1 Meteorology

- 3.6.1.1 Residing on the southeastern shore of Lake Ontario, Rochester's weather is predominantly affected by the lake. Prevailing winds (annual average of 9.5 mph) travel from the northeast across lake and deposit large amounts of precipitation on the southeastern side. Rochester has an average annual precipitation rate of 33.98 inches total and 92.3 inches of snow. On average, the wettest month is August with 3.54 inches of precipitation and the driest being February with 2.05 inches of precipitation. Tornadoes have been recorded in the region and are typically considered infrequent.

3.6.2 Climatology

- 3.6.2.1 The climate in the Rochester, New York area is humid continental with warm, humid summers and cold, dry winters. Surface air temperature is generally moderated by Lake Ontario, resulting in cooler temperatures in the spring and warmer temperatures in the fall than is typical for this latitude. The mean annual air temperature is approximately 48 degrees Fahrenheit (°F). The highest average monthly temperature generally occurs in July (72°F) and the lowest in January (24°F).
- 3.6.2.2 The mean annual precipitation in Rochester, New York is approximately 33 inches. The annual precipitation during the period 1912 through 1992 ranged from 22.5 inches in 1964, to 44 inches in 1945, based on records for the Rochester area compiled by the U.S. Weather Bureau, Rochester-Monroe County Airport Station. Annual total precipitation of 25 inches or more occur with a frequency of greater than once every 10 years. The annual precipitation amounts corresponding to the 25 year and 100 year recurrence drought are approximately 22 and 21 inches, respectively.⁶

⁶ Excerpted from the KPE RFI report, *ibid.*, Section 2.3.

3.6.3 Air Quality

- 3.6.3.1 As rated by the EPA, the Rochester, NY area is in attainment with national ambient air quality standards (NAAQS) for criteria pollutants except for fine particulate matter and ozone during summer months.

3.7 NOISE

- 3.7.1 Ambient noise levels surrounding the EKC site are typical of an urban environment containing a mix of heavy industry, small businesses and large commuter services. Ambient noise levels have not been recorded at or in the vicinity of the EKC site but the proposed action would have no bearing on present levels.

3.8 HISTORIC AND CULTURAL RESOURCES

3.8.1 Historic Maplewood

- 3.8.1.1 The area now known as Maplewood that is immediate to the EKC Research Facility is listed on both the National and New York State Register of Historic Places as an historic district.
- 3.8.1.2 Maplewood Park is located along the west bank of the Genesee River and is slightly south of EKC. Seneca Park is located along the east bank of the Genesee River and is to the immediate east, north and south of EKC. Both parks were part of the overall urban landscape design created for Rochester by Frederick Law Olmsted, Sr., and Company during the 1800's and comprise a portion of the Maplewood district. The architect and company are noted for creating many urban landscapes across the country including Central Park in New York City.
- 3.8.1.3 After the turn of the 20th century, wealthy business men and residents continued to build many elegant buildings and homes in the Maplewood district represented by a broad range of architectural styles and economic levels, from Victorian, Tudor, Queen Anne, Arts and Crafts, Eclectic and Shingle to Colonial and Georgian Revival. Although each house in Maplewood is unique, features commonly found include chestnut, oak, walnut, mahogany, or gumwood trim, and hardwood floors. Many of the structures as well as the parks still exist today, creating a unique living environment.

3.8.2 Lake Avenue Commercial Potential Historic District

- 3.8.2.1 In 2001, the City of Rochester completed its' Consolidated Historic Resources Survey (also known as the Mack Survey). The document serves as a comprehensive catalogue of historic properties for the City of Rochester, NY. The same criteria as used for the National and State Register of Historic Districts was used for compiling data. Proposed in this document to be included as a National and State Historic District is the Lake Avenue Commercial District.
- 3.8.2.2 The district is located south of the EKC Research Facility and is centered around the intersection of Ravine and Lake Avenues and contains 14 properties. Buildings in this proposed district have retained much of their physical integrity and show unconventional uses of architectural styles.

3.9 VISUAL/SCENIC RESOURCES

As previously mentioned, Maplewood and Seneca Parks are located near the EKC facility. Both parks offer a variety of opportunities for the public to enjoy by offering a network of trails, rose gardens, fishing ponds and access to the Genesee River Gorge. Additionally, the Lower Falls of the Genesee River is located to the east of the EKC site and provides the general public with viewing opportunities.

3.10 SOCIOECONOMIC

3.10.1 The following information was tabulated from the U.S. Census Bureau and is based on year 2000 survey of the Maplewood neighborhood (zip code 14613) surrounding the EKC site.

3.10.2 Population Characteristics

3.10.2.1 The total population in 2000 was 15,078 of which 7,293 were male and 7,785 were female. The median age (years) was 28.9. The majority of individuals were 18 years and over (9,834; 65.2%). The 65 years and over group was represented by 1,020 individuals (6.8%). 94.4% of the sample set declared one race. 56.3% were White, 30.1% Black or African American, 12.0% Hispanic or Latino, 2.1% Asian, 0.7% American Indian and Alaska Native, and 5.2% some other race.

3.10.3 Social Characteristics

3.10.3.1 8,140 individuals were 25 years or over. From this subset 6,021 (74%) had graduated from High school or higher and 1,031 (12.7%) had a Bachelor's degree or higher. 931 (9.8%) were civilian veterans (population 18 years and over). 2,922 (22%) had disability status (pop. 5 years and over). 1,079 (7.3%) were foreign born and 2,262 (16.9%) spoke a language other than English at home (pop. 5 years and over).

3.10.4 Economic Characteristics

3.10.4.1 6,645 (66.5%) were in the labor force (pop. 16 years and over). Median household income in 1999 was \$27,668. The median family income was \$29,544. Per capita income was \$13,986. 786 families and 3,517 individuals were below the poverty level.

3.10.5 Housing Characteristics

3.10.5.1 There were 1,851 single-family owner-occupied homes in 1999. The median value was \$57,800. The majority of homes (1,150) were in the \$50,000 to \$99,999 range. 552 were valued below \$50,000 and 50 were valued above \$150,000. In 1999 there were 3,292 renter-occupied units reported. The median rent paid was \$584 with 49% of the units (1,612) paying \$500 to \$749, 23.1% (759) paying \$300 to \$499.

3.11 PUBLIC AND OCCUPATIONAL HEALTH

3.11.1 Sources of Radiation Exposure

3.11.1.1 Table 3.1 below summarizes the various sources of radiation exposure, both natural and man-made, for the average U.S. resident. Assuming a 70-year life span, an individual would receive an average lifetime cumulative dose of about 200 mSv.

Table 3.1
Average Annual Dose from Various Sources

Source	Annual Dose (mSv)
Radon	2.0
Natural Radiation in the Body	0.39
Atmospheric Radiation	0.31
Mammogram	0.3
Medical (x-rays)	0.1
Total	2.8 (male) 3.1 (female)

3.11.2 Historical exposures to radioactive materials

3.11.2.1 Typical dose monitoring results, using film badges, routinely showed occupational exposures to be less than 1 mSv/month for those individuals authorized to work in the immediate vicinity of the CFX. Routine monitoring of laboratory and work areas documented that surfaces were less than 1,000 dpm/100cm² for tritium or 100 pCi/100 cm² for other gamma emitters. These routine monitoring results demonstrated that activities in the vicinity of the CFX were performed in a manner that maintained exposures to radioactive materials ALARA⁷ and did not result in contamination of work areas or personnel. There were never any instances where SNM⁸ contamination was encountered.

3.11.3 Current Sources and Levels of Radiation Exposure

3.11.3.1 The sources of radiation exposure from the CFX are associated with partially spent fuel plates and activation products in the surrounding concrete and equipment. These are described in detail in the CFX Decommissioning Plan.

3.11.3.2 The CFX was permanently shutdown June 12, 2006. The activation products are rapidly decaying away such that the 6 month shutdown dose rate estimates at 2 feet from the unshielded CFX would result in exposures of 0.0015 mSv/hr. At this exposure rate, it would take more than 2,000 hours for an individual to exceed an administrative limit of 5 mSv/yr.

⁷ As Low As Reasonably Achievable

⁸ Special Nuclear Material

3.11.4 Major sources and levels of chemical exposures

3.11.4.1 There are no chemicals in use or associated with the CFX.

3.12 WASTE MANAGEMENT

- 3.12.1 The EKC Activation Analysis Laboratory does not generate waste in its normal course of operation. Small scale chemical samples delivered to laboratory for activation analyses were returned to the generator following analysis. All radioactive sources continue to remain in a sealed condition therefore no disposable items such as gloves, shoe covers, paper towels etc. have become radiologically contaminated thus requiring a separate waste stream. Additionally, the laboratory does not use toxic or hazardous chemicals during its normal course of operation therefore hazardous waste has not been a concern.
- 3.12.2 Consumable wastes (paper, cardboard, plastics etc.) generated by the laboratory and destined for municipal landfill are governed by the EKC ISO 14001 Environmental Program to ensure practical measures are in place to reduce, reuse and recycle.
- 3.12.3 The proposed action of off-site disposal of the MTR-type fuel plates may possibly generate a one-time waste stream of irradiated or radiologically contaminated materials. The volume is not expected to be no larger than one cubic yard of tritium impregnated material (See DPlan for further discussion). The material will be packaged according to applicable NRC and US Department of Transportation protocols and shipped to an approved landfill for disposal.

4 ENVIRONMENTAL IMPACTS

4.1 Environmental impacts associated with each of the three alternatives presented in 2.0 are described below. The outline follows the same outline presented in 3.0.

4.2 LAND USE IMPACTS

4.2.1 No-Action Alternative

4.2.1.1 Under the No-Action Alternative, portions of EKC Building 82 (radiation cavity) would not be decommissioned and would continue to house the CFX assembly and associated HEU fuel plates. EKC would continue to keep the building under security surveillance and the radiation cavity would continue to be restricted to authorized personnel. Further development of the land for other beneficial uses would be prohibited.

4.2.2 Off-Site Disposal (Proposed Action)

4.2.2.1 Under the Off-Site Disposal option, the radiation cavity would be decommissioned and the licensed terminated after demonstrated compliance to 10 CFR 20, Appendix E. The land would be available for other beneficial uses. No land on the EKC campus would be impacted. During the decommissioning process, ground-level corridors and the loading dock would be temporarily restricted to authorized personnel.

4.2.3 On-Site Disposal

- 4.2.3.1 Under the On-Site Disposal option, a site in the EKC campus would be selected for long-term storage of radioactive material. EKC would erect secure boundaries around the site to protect the health and safety of the public and environment and provide the necessary resources to ensure the materials' security. Land devoted for this use would be restricted from further development. Land transfer to other entities would be restricted by covenant.

4.3 TRANSPORTATION IMPACTS

4.3.1 No-Action Alternative

- 4.3.1.1 No impacts to the transportation system would occur with this alternative. Site personnel would continue to commute to the site. In the event of temporary or permanent facility shut-down, security personnel would be expected to continue working at the site potentially using public transportation routes.

4.3.2 Off-Site Disposal (Proposed Action)

- 4.3.2.1 The proposed action would use one tractor-trailer to transport shipping containers to a DOE facility. The distances from Rochester, NY to the DOE Y-12 and Savannah facilities are 750 miles and 870 miles respectively. The incident-free scenario would result in no dose to the public and less than 1 mSv to workers who will be responsible for handling the fuel plates and loading the shipping containers. Approximately six 6M containers with 2R inner receptacles would be used to remove the fuel plates from the radiation cavity and would act as the shipping containers to the DOE facility. A DOE representative would be on-site to review the packaging of the fuel plates and affix appropriate custody seals. The noise generated from one tractor-trailer would not be significant in relation to ambient noise levels. No impact to local, state or federal roads and highways would occur.
- 4.3.2.2 If contaminated or irradiated material is discovered during the decommissioning process one additional shipping vehicle would be utilized to transport radioactive waste to the appropriately licensed disposal facility. Again, no impact to local, state or federal roads and highways would occur.
- 4.3.2.3 Transportation accident risks are based on exposure to radioactive material released as a direct result of an accident during transportation. The accident risk is based on the accident rate, probability of container failure, fraction of material released, chemical and physical nature of the material, radioactivity of the material, and proximity of individuals to the accident site. The probability of a traffic accident involving a truck carrying radioactive material is one accident for every 1,000,000 vehicle-miles. If an accident occurs, the probability that the accident will involve a significant release of radioactive materials is less than 5%. The exact route, type of container and size of the package are unknown and effectively prevent an accurate estimation of the transportation risk. Having said that, it is known that the waste will be contained within a single shipment of one or perhaps two packages. As an example, calculation of risk from transportation accidents for the Low Level Waste Facility in Richland, Washington utilizing the

RADTRAN code estimated risks at 1 E-08 along all transportation routes. Given the small amount of radioactive material contained within the fuel plates, it is difficult to imagine that the transportation risks would exceed these estimates by an order of magnitude at the most. Any significant transportation risk is therefore removed from further quantitative consideration.

4.3.3 On-Site Disposal

- 4.3.3.1 The construction of an on-site long-term storage area would require additional personnel and the use of heavy equipment. Although not permanent, Lake Avenue traffic patterns would be temporarily disrupted as heavy machinery enters and exits the site. Noise levels on-site would increase with a possibility of the local residential neighborhood being disrupted. Normal daylight work hours would be maintained to mitigate noise disturbances. A specialized truck would be used to carry radioactive material from the decommissioning area to the storage area.

4.4 GEOLOGY AND SOILS IMPACTS

4.4.1 No-Action Alternative

- 4.4.1.1 Under the No-Action Alternative, changes to the geology or soil would not be required. The region is not affected by active faults or volcanoes, but plans, procedures and training would be required to account for such an event.

4.4.2 Off-Site Disposal (Proposed Action)

- 4.4.2.1 Under the proposed action, changes to the geology or soil would not be required.

4.4.3 On-Site Disposal

- 4.4.3.1 The construction of a long-term storage area would require digging for, at a minimum, the preparation of a foundation. Drainage patterns would be altered to mitigate against deterioration of the storage foundation and structure.

4.5 WATER RESOURCES IMPACT

- 4.5.1 The surface and ground water systems would not be impacted long-term by any of the three alternatives.
- 4.5.2 Under the On-Site disposal option, construction of an on-site storage facility would require disrupting, at a minimum, the ground surface. Storm water run-off would be affected by the disturbed soil. Barriers and catch basins would be employed during the construction phase to prohibit highly turbid run-off from entering drains that lead to the Genesee River or its tributaries.

4.6 ECOLOGICAL RESOURCES IMPACT

- 4.6.1 The EKC site area currently offers no wildlife habitat suitable for species as described in 3.5. Under both the No-Action and Off-Site Disposal Alternatives, no ecological resources would be impacted.
- 4.6.2 Under the On-Site Disposal Alternative, endangered and threatened species would not be impacted due, in part, to the urban surroundings and lack of wildlife habitat.

However, noise during the construction phase of a long-term storage area may intermittently impact species that otherwise tolerate a high degree of human disturbance (e.g. American Robin, European Starling, House Sparrow and Gray Squirrel).

4.7 AIR QUALITY IMPACTS

- 4.7.1 Air quality would not be impacted by any of the three alternatives. Under the On-Site Disposal Alternative, diesel exhaust emissions would be intermittently generated during the construction phase but would be too insignificant to remotely affect the air quality index or be detrimental to visibility.

4.8 NOISE IMPACTS

4.8.1 No-Action Alternative

- 4.8.1.1 Under the No-Action Alternative, noise would not be generated.

4.8.2 Off-Site Disposal (Proposed Action)

- 4.8.2.1 Under the Off-Site Disposal Alternative, the operation of one (possibly two) tractor-trailer(s) would generate noise levels insignificant to ambient noise levels during normal day-time working hours.

4.8.3 On-Site Disposal

- 4.8.3.1 Noise levels of heavy machinery would be monitored during construction of the storage facility. Personal hearing loss prevention devices would be available in accordance to U.S. Occupational Safety and Health Agency standards.

4.9 HISTORIC AND CULTURAL IMPACTS

- 4.9.1 Historic and cultural resources would not be impacted by any of the alternatives. Since activities would occur within the confines of the EKC campus, historic buildings or sites would not be altered, demolished or relocated.

4.10 VISUAL/SCENIC RESOURCES IMPACTS

- 4.10.1 Visual/Scenic Resources would not be impacted by any of the alternatives.

4.11 SOCIOECONOMIC IMPACTS

4.11.1 No-Action Alternative

- 4.11.1.1 Under the No-Action Alternative, labor resources would be required to indefinitely maintain the CFX and associated fuel plates in a safe and secure condition.
- 4.11.1.2 Eastman Kodak Company is a leading employer in the region and is currently in a major corporate transformation which includes significant restructuring and downsizing of the company. This alternative would ultimately be deleterious to the economy due to the financial pressures that maintaining a NRC license has on the owner.

4.11.2 Off-Site Disposal (Proposed Action)

- 4.11.2.1 Under the proposed action, temporary labor would be required to perform the decommissioning activities. Duration would not require more than four temporary laborers and would not exceed two weeks.

4.11.3 On-Site Disposal

- 4.11.3.1 Under the On-Site Disposal Alternative, temporary labor would be used to design, consult and construct the long-term storage unit and would be a temporary benefit to the area economy. However, the long-term effect of this alternative is comparable to 4.10.1.

4.12 ENVIRONMENTAL JUSTICE

- 4.12.1 Each of the presented alternatives would take place within the confines of the EKC Research Park. Area minority or low-income individuals would not be impacted.

4.13 PUBLIC AND OCCUPATIONAL HEALTH IMPACTS

4.13.1 No-Action Alternative

- 4.13.1.1 Under the No-Action Alternative, labor resources would be required to indefinitely maintain the CFX and associated fuel plates in a safe and secure condition and the historical dose rates and contamination levels from radioactivity described in Section 3.11 would be characteristic of future experience.

4.13.2 Off-Site Disposal (Proposed Action)

- 4.13.2.1 Major sources and levels of chemical exposures. There are no chemicals in use or associated with the CFX or its decommissioning.
- 4.13.2.2 Sources and Levels of Radiation Exposure. The sources of radiation exposure from the CFX are associated with partially spent fuel plates and activation products in the surrounding concrete and equipment. These are described in detail in the CFX Decommissioning Plan.
- 4.13.2.3 Current planning for the CFX disassembly and decommissioning work to be done indicates that radiation workers assigned to the project will receive no more than 1mSv total dose from the entire project. This is well below the administrative limit of 5 mSv and significantly less than the 10 CFR 20 limit of 50 mSv/yr. No dose whatsoever is anticipated for the general public.
- 4.13.2.4 Occupational Injury Rates and Occupational Fatality Rates. Perhaps the closest related NAICS code to the work to be performed is NAICS code 562 – waste management and remediation services. The 2005 injury rate is 2.1 E-05 based upon 334,000 individuals employed in the profession⁹. For the same year, there were 79 deaths, 44 of those related to transportation accidents for a fatality rate of 2.4 E-04. Many of these accidents/illnesses are not necessarily related to the

⁹ <http://www.bls.gov/iif/oshwc/osh/os/ostb1619.pdf>

nuclear industry, which traditionally has a lower overall accident rate than comparable industries.

4.13.2.5 In the U.S. since 1980, there were a total of 13 fatalities and 9 injuries resulting from the use of radioactive materials or sources. This includes activities at major radioactive sites such as power plants and reactors. The very limited expected dose rates for the CFX Decommissioning Project indicate a negligible probability that occupational injury or fatality may occur due to radiation alone.

4.13.2.6 Summary of health effects studies. Risk from exposure to radiation is defined as the probability that a person will be harmed by radiation. Most commonly, radiation risk refers to the probability of death from cancer. It is well established that very high radiation doses of about 4 Sv, administered at a high dose rate, are fatal. It is also established that doses greater than about 0.1 to 0.2 Sv, administered at high dose rates, may cause cancer. There is no direct evidence of harm for acute (sudden) exposures less than 0.1 Sv and much less for exposures that are spread out over time.

4.13.2.7 Since expected levels of exposure are two orders of magnitude less than 0.1 Sv, and since any exposure during project work will be received at low rates, the expected occupational dose will have no impact on the health and safety of workers.

4.13.3 On-Site Disposal

4.13.3.1 On site disposal and care of the CFX spent fuel would require the government to establish on EKC property a high level radioactive waste disposal site. Since this is a virtual impossibility no further consideration can be given to this option.

4.14 WASTE MANAGEMENT IMPACTS

4.14.1 No-Action Alternative

4.14.1.1 Under the No-Action Alternative, no solid, hazardous, radioactive or mixed waste would be generated.

4.14.2 Off-Site Disposal (Proposed Action)

4.14.2.1 Under the proposed action, the fuel plates, contaminated material, irradiated material, and consumables (e.g. wipes, gloves) would be declared radioactive waste and would be transferred to an off-site waste disposal facility. Materials used for the shielding or assembly of the CFX that are released but not useful for other purposes will be disposed as solid waste at a municipal landfill. No hazardous or mixed waste would be generated.

4.14.3 On-Site Disposal

4.14.3.1 Under the On-Site Disposal alternative, contaminated material, irradiated material and consumables generated during decommissioning would be declared radioactive waste and would be transferred to an off-site waste disposal facility.

5 MITIGATING MEASURES

- 5.1 For each of the proposed alternatives, mitigating measures would be in place to reduce or preclude adverse impacts to public health and safety and the environment. Decommissioning activities for the both the On-Site and Off-Site Alternatives would be governed by task related work plans and work permits to establish clear direction and responsibilities. The No-Action Alternative would include specific post CFX operation procedures to ensure the assembly is monitored and remains in an acceptable condition.

6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 RADIOLOGICAL MONITORING

6.1.1 No-Action Alternative

- 6.1.1.1 Under the No-Action alternative, routine swipe samples (leak testing) would continue to be collected from the area and the CFX assemblies at 6 month intervals to confirm the fuel plates remain in a safe and sealed condition. Additionally, area radiological monitors would continue to be employed to alert personnel of a radiological status change inside the radiation cavity. Authorized personnel would continue to wear personal dosimeters when entering the radiation cavity.

6.1.2 Off-Site Disposal (Proposed Action)

- 6.1.2.1 Decommissioning activities during the proposed action would be monitored via personal dosimeters, radiation cavity monitors and air sampling. Additionally, non-permanent items in the area would be scanned for radiological contaminants before release. Fixed items and building structures would be surveyed using sampling criteria set for the in NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual*. See the EKC CFX Decommissioning Plan for further discussions on survey techniques, instrumentation, detection levels, and release criteria.

6.1.3 On-Site Disposal

- 6.1.3.1 Under the On-Site Disposal Alternative, the same types of monitoring discussed in 6.1.2 would be employed during the decommissioning process. Additionally, perimeter dosimeters would be used during and after construction of the long-term storage vault to monitor exposure to workers, public, and the environment.

6.2 PHYSIOCHEMICAL MONITORING

- 6.2.1 Due to the physical nature of the MTR-type fuel plates (sealed sources) and the operational history of the CFX (indoors), no physiochemical monitoring of the radiation cavity or the site has been conducted nor is it planned for decommissioning activities.

6.3 ECOLOGICAL MONITORING

Due to the physical nature of the MTR-type fuel plates (sealed sources) and the operational history of the CFX (indoors), no environmental monitoring of the radiation cavity or the site has been conducted nor is it planned for decommissioning activities.

7 COST BENEFIT ANALYSIS

7.1 NO-ACTION ALTERNATIVE

- 7.1.1 Under the No-Action Alternative, no environmental or socioeconomic impacts would be realized.
- 7.1.2 Portions of EKC Building 82 would remain restricted and further considerations for beneficial use by EKC would be negated.
- 7.1.3 The site grounds and the radiation cavity would remain under surveillance and authorized personnel would continue to be monitored for exposure. Operating costs associated with security and monitoring would continue indefinitely at the present rate adjusted for inflation. NRC License fees and maintenance costs would continue.
- 7.1.4 Public and worker health and safety would be potentially impacted by the presence and availability of HEU.

7.2 OFF-SITE DISPOSAL (PROPOSED ACTION)

- 7.2.1 Since the scale of the proposed action is relatively small in scale, socioeconomic and environmental characteristics would not be impacted.
- 7.2.2 The proposed action would immediately show a cost benefit to EKC via the reduction of NRC License fees and maintenance costs. Portions of Building 82 would be unconditionally released for other beneficial uses.
- 7.2.3 Radiological programs, procedures, and monitoring practices associated with the CFX would be discontinued; however, security would remain on site post decommissioning.
- 7.2.4 The presence and availability of HEU would be eliminated, stabilizing any threat to public health and safety and the environment.
- 7.2.5 In comparison to the other alternatives, the proposed action has a moderate initial cost, without long-term resource allocations.

7.3 ON-SITE DISPOSAL

- 7.3.1 Under the On-Site Disposal Alternative, environmental or socioeconomic impacts would be realized.
- 7.3.2 Since this alternative is regarded as impractical, detailed estimates of constructing a long-term containment area have not been acquired, however, it is reasonable to expect that the storage facility would well exceed one (if not several) million dollars for completion. Additionally, costs associated with gaining appropriate disposal facility permits, continuing NRC licensure, dedicating and restricting land, and

maintaining security and monitoring programs, would adversely impact EKC's financial future.

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

- 8.1 Considering the nature of the MTR-Type fuel plates (sealed sources), the safe operating history of the CFX, and the scope of decommissioning activities, unavoidable adverse environmental impacts and irreversible and irretrievable commitments of resources are not immanent for the Off-Site Disposal Alternative (proposed action).
- 8.2 The No-Action Alternative would require long-term security resources and radiological monitoring. This alternative is contrary to NRC license conditions and would subject EKC to foreseeable legal actions.
- 8.3 The On-Site Disposal Alternative would entail a permanent long-term containment area that would require indefinite security resources and radiological monitoring. Land used for on-site disposal would be restricted and would provide no beneficial use to EKC or the surrounding community.

9 LIST OF REFERENCES

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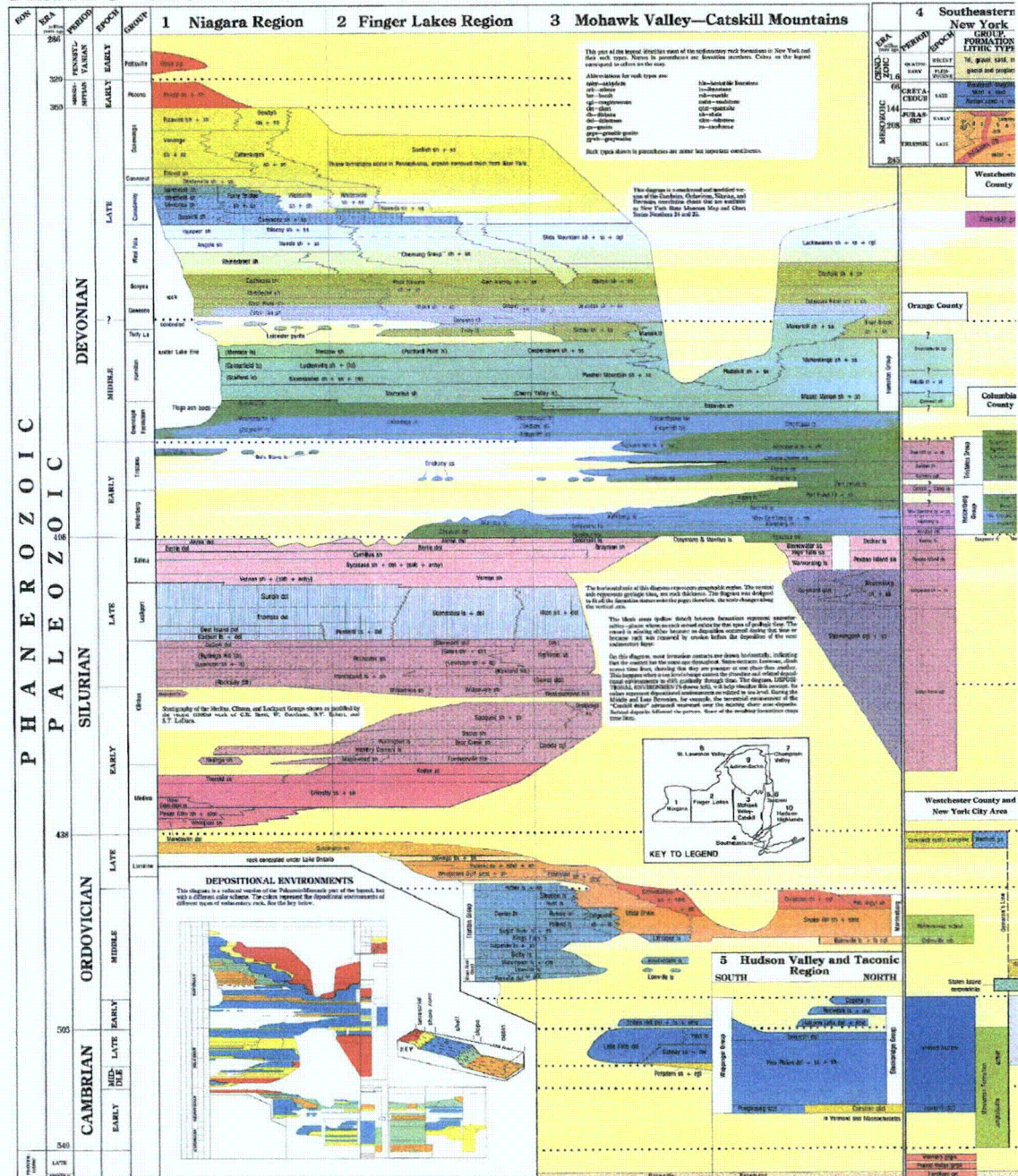
APPENDIX B

New York Geological Map and Legend

ONTARIO

New York State Geology

PLATE 3 LEGEND FOR GEOLOGIC MAP



APPENDIX C

Species of Importance

ENDANGERED

Those endangered species which meet one or both of the criteria specified in section 182.2(g) of 6NYCRR Part 182 and which are found, have been found, or may be expected to be found in New York State include:

	Common Name	Scientific Name
Molluscs	¹ <u>Dwarf Wedgemussel</u>	<i>Alasmidonta heterodon</i>
	¹ Pink mucket	<i>Lampsilis abrupta</i>
	¹ Clubshell	<i>Pleurobema clava</i>
	¹ Fat pocketbook	<i>Potamilus capax</i>
	Rayed Bean	<i>Villosa fabalis</i>
	² <u>Chittenango Ovate Amber Snail</u>	<i>Novisuccinea chittenangoensis</i>
Insects	Tomah Mayfly	<i>Siphonisca aerodromia</i>
	^{1,3} <u>American Burying Beetle</u>	<i>Nicrophorus americanus</i>
	Hessel's Hairstreak	<i>Callophrys hesseli</i>
	¹ <u>Karner Blue</u>	<i>Lycaeides melissa samuelis</i>
	Regal Fritillary	<i>Speyeria idalia</i>
	Persius Duskywing	<i>Erynnis persius</i>
	Grizzled Skipper	<i>Pyrgus centaureae wyandot</i>
	Arogos Skipper	<i>Atrytone arogos arogos</i>
	Bog Buckmoth	<i>Hemileuca species 1</i>
	Pine Pinion Moth	<i>Lithophane lepida lepida</i>
Fishes	¹ <u>Shortnose Sturgeon</u>	<i>Acipenser brevirostrum</i>
	³ <u>Silver Chub</u>	<i>Macrhybopsis storeriana</i>
	<u>Pugnose Shiner</u>	<i>Notropis anogenus</i>
	<u>Round Whitefish</u>	<i>Prosopium cylindraceum</i>
	<u>Bluebreast Darter</u>	<i>Etheostoma camurum</i>

	³ Gilt Darter	<i>Percina evides</i>
	³ Spoonhead Sculpin	<i>Cottus ricei</i>
	Deepwater Sculpin	<i>Myoxocephalus thompsoni</i>
Amphibians	Tiger Salamander	<i>Ambystoma tigrinum</i>
	Northern Cricket Frog	<i>Acris crepitans</i>
Reptiles	Mud Turtle	<i>Kinosternon subrubrum</i>
	² Bog Turtle	<i>Clemmys muhlenbergii</i>
	¹ Atlantic Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>
	¹ Atlantic Ridley Sea Turtle	<i>Lepidochelys kempii</i>
	¹ Leatherback Sea Turtle	<i>Dermochelys coriacea</i>
	Queen Snake	<i>Regina septemvittata</i>
	Massasauga	<i>Sistrurus catenatus</i>
Birds	Spruce Grouse	<i>Falci pennis canadensis</i>
	³ Golden Eagle	<i>Aquila chrysaetos</i>
	Peregrine Falcon	<i>Falco peregrinus</i>
	Black Rail	<i>Laterallus jamaicensis</i>
	^{1,2,4} Piping Plover	<i>Charadrius melodus</i>
	^{1,3} Eskimo Curlew	<i>Numenius borealis</i>
	¹ Roseate Tern	<i>Sterna dougallii dougallii</i>
	Black Tern	<i>Chlidonias niger</i>
	Short-eared Owl	<i>Asio flammeus</i>
	Loggerhead Shrike	<i>Lanius ludovicianus</i>
Mammals	¹ Indiana Bat	<i>Myotis sodalis</i>
	³ Allegheny Woodrat	<i>Neotoma magister</i>
	¹ Sperm Whale	<i>Physeter catodon</i>
	¹ Sei Whale	<i>Balaenoptera borealis</i>

¹ <u>Blue Whale</u>	<i>Balaenoptera musculus</i>
¹ <u>Finback Whale</u>	<i>Balaenoptera physalus</i>
¹ <u>Humpback Whale</u>	<i>Megaptera novaeangliae</i>
¹ <u>Right Whale</u>	<i>Eubalaena glacialis</i>
^{2,3} <u>Gray Wolf</u>	<i>Canis lupus</i>
^{1,3} <u>Cougar</u>	<i>Felis concolor</i>

THREATENED

Those threatened species which meet one or both of the criteria specified in section 182.2(h) of 6NYCRR Part 182 and which are found, have been found, or may be expected to be found in New York State include:

	Common Name	Scientific Name
Molluscs	Brook Floater	<i>Alasmidonta varicosa</i>
	Wavy-rayed Lampmussel	<i>Lampsilis fasciola</i>
	Green Floater	<i>Lasmigona subviridis</i>
Insects	Pine Barrens Bluet	<i>Enallagma recurvatum</i>
	Scarlet Bluet	<i>Enallagma pictum</i>
	Little Bluet	<i>Enallagma minisculum</i>
	^{2,3} <u>Northeastern Beach Tiger Beetle</u>	<i>Cicindela dorsalis dorsalis</i>
	Frosted Elfin	<i>Callophrys irus</i>
Fishes	<u>Lake Sturgeon</u>	<i>Acipenser fulvescens</i>
	Mooneye	<i>Hiodon tergisus</i>
	³ <u>Lake Chubsucker</u>	<i>Erimyzon sucetta</i>
	Gravel Chub	<i>Erimystax x-punctata</i>
	³ <u>Mud Sunfish</u>	<i>Acantharchus pomotis</i>
	<u>Banded Sunfish</u>	<i>Enneacanthus obesus</i>
	<u>Longear Sunfish</u>	<i>Lepomis megalotis</i>

	<u>Longhead Darter</u>	<i>Percina macrocephala</i>
	<u>Eastern Sand Darter</u>	<i>Ammocrypta pellucida</i>
	<u>Swamp Darter</u>	<i>Etheostoma fusiforme</i>
	<u>Spotted Darter</u>	<i>Etheostoma maculatum</i>
Amphibians	None Listed	
	<u>Blanding's Turtle</u>	<i>Emydoidea blandingii</i>
	² <u>Green Sea Turtle</u>	<i>Chelonia mydas</i>
Reptiles	² <u>Loggerhead Sea Turtle</u>	<i>Caretta caretta</i>
	<u>Fence Lizard</u>	<i>Sceloporus undulatus</i>
	<u>Timber Rattlesnake</u>	<i>Crotalus horridus</i>
	<u>Pied-billed Grebe</u>	<i>Podilymbus podiceps</i>
	<u>Least Bittern</u>	<i>Ixobrychus exilis</i>
	² <u>Bald Eagle</u>	<i>Haliaeetus leucocephalus</i>
	<u>Northern Harrier</u>	<i>Circus cyaneus</i>
Birds	<u>King Rail</u>	<i>Rallus elegans</i>
	<u>Upland Sandpiper</u>	<i>Bartramia longicauda</i>
	<u>Common Tern</u>	<i>Sterna hirundo</i>
	<u>Least Tern</u>	<i>Sterna antillarum</i>
	<u>Sedge Wren</u>	<i>Cistothorus platensis</i>
	<u>Henslow's Sparrow</u>	<i>Ammodramus henslowii</i>
Mammals	^{2,3} <u>Canada Lynx</u>	<i>Lynx canadensis</i>

SPECIAL CONCERN

The following are designated as species of special concern as defined in Section 182.2(i) of 6NYCRR Part 182. Species of special concern warrant attention and consideration but current information, collected by the department, does not justify listing these species as either endangered or threatened.

	Common Name	Scientific Name
Molluscs	Buffalo Pebble Snail	<i>Gillia altilis</i>
	Fringed Valvata	<i>Valvata lewisi</i>
	Mossy Valvata	<i>Valvata sincera</i>
Insects	Unnamed Dragonfly Species	<i>Gomphus spec. nov.</i>
	Southern Sprite	<i>Nehalennia integricollis</i>
	Extra Striped Snaketail	<i>Ophiogomphus anomalus</i>
	Pygmy Snaketail	<i>Ophiogomphus howei</i>
	Common Sanddragon	<i>Progomphus obscurus</i>
	Gray Petaltail	<i>Tachopteryx thoreyi</i>
	Checkered White	<i>Pontia protodice</i>
	Olympia Marble	<i>Euchloe olympia</i>
	Henry's Elfin	<i>Callophrys henrici</i>
	Tawny Crescent	<i>Phyciodes batesii</i>
	Mottled Duskywing	<i>Erynnis martialis</i>
	Barrens Buckmoth	<i>Hemileuca maia</i>
	Herodias Underwing	<i>Catocala herodias gerhardi</i>
	Jair Underwing	<i>Catocala jair</i>
	A Noctuid Moth	<i>Heterocampa varia</i>
Fishes	Mountain Brook Lamprey	<i>Ichthyomyzon greeleyi</i>
	Black Redhorse	<i>Moxostoma duquesnei</i>
	Streamline Chub	<i>Erymystax dissimilis</i>

	Redfin Shiner	<i>Lythrurus umbratilis</i>
	Ironcolor Shiner	<i>Notropis chalybaeus</i>
Amphibians	Hellbender	<i>Cryptobranchus alleganiensis</i>
	Marbled Salamander	<i>Ambystoma opacum</i>
	Jefferson Salamander	<i>Ambystoma jeffersonianum</i>
	Blue-spotted Salamander	<i>Ambystoma laterale</i>
	Longtail Salamander	<i>Eurycea longicauda</i>
	Eastern Spadefoot Toad	<i>Scaphiopus holbrookii</i>
	Southern Leopard Frog	<i>Rana sphenoccephala</i> <i>utricularius</i>
Reptiles	Spotted Turtle	<i>Clemmys guttata</i>
	Wood Turtle	<i>Clemmys insculpta</i>
	Eastern Box Turtle	<i>Terrapene carolina</i>
	Eastern Spiny Softshell	<i>Apalone spinifera</i>
	Eastern Hognose Snake	<i>Heterodon platyrhinos</i>
	Worm Snake	<i>Carphophis amoenus</i>
Birds	Common Loon	<i>Gavia immer</i>
	American Bittern	<i>Botaurus lentiginosus</i>
	Osprey	<i>Pandion haliaetus</i>
	Sharp-shinned Hawk	<i>Accipiter striatus</i>
	Cooper's Hawk	<i>Accipiter cooperii</i>
	Northern Goshawk	<i>Accipiter gentilis</i>
	Red-shouldered Hawk	<i>Buteo lineatus</i>
	Black Skimmer	<i>Rynchops niger</i>
	Common Nighthawk	<i>Chordeiles minor</i>
	Whip-poor-will	<i>Caprimulgus vociferus</i>

	Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>
	Horned Lark	<i>Eremophila alpestris</i>
	Bicknell's Thrush	<i>Catharus bicknelli</i>
	Golden-winged Warbler	<i>Vermivora chrysoptera</i>
	Cerulean Warbler	<i>Dendroica cerulea</i>
	Yellow-breasted Chat	<i>Icteria virens</i>
	Vesper Sparrow	<i>Pooecetes gramineus</i>
	Grasshopper Sparrow	<i>Ammodramus savannarum</i>
	Seaside Sparrow	<i>Ammodramus maritimus</i>
Mammals	Small-footed Bat	<i>Myotis leibii</i>
	New England Cottontail	<i>Sylvilagus transitionalis</i>
	Harbor Porpoise	<i>Phocoena phocoena</i>

¹Currently listed as "endangered" by the U. S. Department of the Interior.

²Currently listed as "threatened" by the U. S. Department of the Interior.

³Species is extirpated from New York State.

⁴Piping Plover is listed as federally endangered in the Great Lakes Region, and as federally threatened in the Atlantic Coastal Region.